#### CLASS VI CRITICAL PRESSURE CALCULATION

#### **ELK HILLS 26R PROJECT**

# **Critical Pressure Calculation**

As discussed in the Project Narrative document, there is no known USDW with groundwater within the area of review of the project. The Lower Tulare Zone is an exempt aquifer within the project AoR as shown in Figure 1 below.



Figure 1: Lower Tulare aquifer exemption area.

The Upper Tulare zone is characterized as being unsaturated air sands that are dry or at irreducible water saturation in the AoR. For completeness, the Critical pressure calculations for a saturated, normally pressured Upper Tulare zone are discussed below.

## Upper Tulare USDW Inputs

The unconfined Upper Tulare Formation within the area of review (AoR) is an open aquifer that onlaps onto the anticline structure. The Upper Tulare within the AoR is an unsaturated zone with no groundwater present. Figure 2 shows the Tulare Formation type wells, note the unsaturated zone by the neutron density cross-over shaded pink and red that is indicative of air sands. For the critical pressure calculation, CTV used the average base of the Upper Tulare within the AoR.

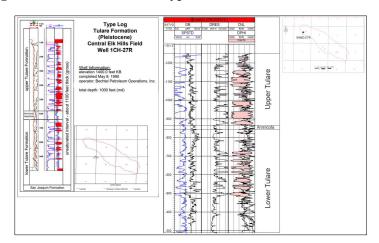


Figure 2: Tulare Formation type wells 1CH-27R and 54WD-27R.

## Computational Modeling Monterey Formation A1-A2 Pressure

The Monterey Formation 26R reservoir has been depleted by oil and gas production. Currently the pressure of the reservoir is estimated to be 150 PSI at a datum of 5,630 ft TVD below Mean Sea Level (MSL). The final average reservoir pressure will be at or below the initial reservoir conditions (3,250 PSI).

#### Critical Pressure Calculation

Using the equation below, and assuming the Upper Tulare has been saturated and is at normal pressure, the critical pressure for the Monterey Formation 26R reservoir is about 2,651 PSI for the project area.

$$P_{i, f} = \frac{\rho_i}{\rho_u} P_u + g \rho_i (Z_i - Z_u)$$

Where,

P<sub>i,f</sub> – Injection zone Pressure

P<sub>u</sub> – Base of USDW zone pressure, (assuming normally pressured, 217 psi or 1,498,686 Pa)

ρi – injection zone brine density, 1017 kg/m3

ρ<sub>u</sub>- USDW zone water density, 1003 kg/m3

Zi – Injection zone depth 6014 ft TVD or 1833 m TVD

Zu – Base of USDW zone depth, 502 ft TVD or 153 m TVD

g – acceleration due to gravity, 9.81m/s2

# Summary of AoR

The final pressure of the Monterey Formation 26R reservoir will be at or below the initial reservoir pressure to ensure that CO2 occupies the same pore space that was initially saturated with hydrocarbons and the pressure front is at equilibrium with initial conditions. As such, CTV defines the AoR as the aerial extent of the CO2 plume.